Laboratory 8
Motor Control and Temperature Monitoring System

Due Date: _____

Name:_____

Name:_____

Points: 100 Points

You may work individually, or in pairs and submit a joint report.

Objective: The purpose of this laboratory is to develop a fuel control and temperature monitoring subsystem capability using a PIC32MX microcontroller with: an LCD Display, a temperature PMOD module, an 8 LED PMOD module, and a breadboard that provides an analog input. You will be using c function libraries that are included using the *#include <plib.h>* command in your c source file. The c library reference manuals are posted on UNM Learn. SPI sample codes are also posted on Learn.

Background: The power output of an internal combustion engine is controlled by regulating the input of fuel and air. In older vehicles, this control was provided through the gas pedal to a carburetor using a mechanical linkage assembly. As electronic component capabilities evolved, manufacturers adopted a fly-by-wire approach, where an electronic transducer converts the pressure on the gas pedal to an electronic signal that is sent to a controller, which regulates flow of fuel to the injectors.

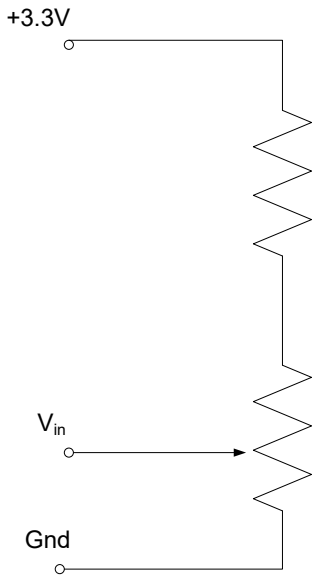
As the engine speed increases, or if it is subjected to a heavy load, fuel consumption and engine temperature increase. When the temperature exceeds some safe value, the operator must be notified and the engine slowed down to prevent damage.

Activities: For this assignment, will be implementing a system that monitors the pressure on the gas pedal and the engine temperature. You will configure a voltage divider circuit that uses a potentiometer to provide a variable input voltage signal, which will be processed by the analog to digital converter (ADC). The ambient temperature will be measured using the TMP3 module.

The variable voltage analog signal will simulate the signal generated by a transducer this is proportional to the pressure on the gas pedal. You will establish voltage levels that range from no pressure on the pedal to the gas pedal being "floored" (i.e. pressed all the way to the floor). (Note: no pressure on the pedal does not have to be zero volts – you set the scale.) When the input signal is at a voltage that reflects the gas pedal being fully depressed, 8 LEDs shall be lit. As the voltage level drops, you will turn off LEDs in a corresponding manner. As the voltages reaches a level corresponding to no pressure, no LEDs should be lit.

You will measure the ambient room temperature using the TMP3 module and display the value on the LCD display. You will display the value in degrees Fahrenheit. (The module outputs temperature in degrees Celsius.) Typical room temperature is about 73ºF. When the temperature reaches 80ºF, you will display a second flashing message on the LCD Display that says: "Overheated!". (You can cause the temperature to reach this temperature by placing your finger on the temperature sensing integrated circuit on the TMP3 module.)

Your voltage divider circuit will be configured as shown in the figure to the right. Ensure that you never have the +3.3 Volt signal tied directly to ground.



Notes: The LCD display and breadboard modules are connected to the Chipkit board using standard pmod cables. Verify that the Chipkit board jumpers are configured properly, to ensure that the pmod boards are powered. You can test the wiring and terminal configurations using the sample codes.

Documentation: Your lab activities must be documented following the guidelines that are provided on the course UNM Learn site. You must also demonstrate that your project functions properly to one of our TAs; who will then sign your copy of this assignment sheet.

Reference Information:

- Cerebott MX4cK™ Board Reference Manual
- PIC32MX3XX/4XX Data Sheet
- PIC32 Peripheral Libraries for MPLAB C32 Compiler
- PmodCLS Serial LCD Display Module Reference Manual
- PmodTMP3 Temperature Sensor Reference Manual
- PIC32 Reference Manual Serial Peripheral Interface
- PIC32 Reference Manual I2C Interface
- PIC32 Reference Manual Analog-to-Digital Converter (ADC)

Suggestion: Keep all of your files on a USB memory device as there is no guarantee that any information you store on lab machines will be preserved. On occasion, the machines must cleaned and reloaded, so any information stored on them will be lost.